

M e m o r a n d u m

Date: May 17, 2011

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To: Vice Chairman James D. Boyd, Presiding Member
Paul Kramer, Chief Hearing Officer

From: California Energy Commission –
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DOCKET
07-AFC-6

DATE 05/17/11

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**Subject: SUPPLEMENTAL FILINGS FOR THE May 19, 2011 CARLSBAD
ENERGY CENTER PROJECT (07-AFC-6) PRESIDING MEMBER'S
PROPOSED DECISION HEARING**

On March 29, 2011, Staff docketed and sent to the POS list the nitrogen dioxide (NO₂) analysis provided by the San Diego Air Pollution Control District related to Carlsbad Energy Center Project's compliance with the new federal air quality standard for NO₂. Attached as Exhibit A is the supplementary testimony of Dr. Alvin Greenberg, describing possible additional measures that could further reduce transformer fire risk. Staff believes that its analysis in the Carlsbad Energy Center Project Final Staff Assessment regarding fire and public safety is correct, and that power plant fire risk has been adequately addressed. However, should the Committee be interested in further measures to avoid or contain transformer fires, it may want to adopt the additional condition discussed in Exhibit A.

Exhibit A includes two additional components: first, the Committee, in its recent Notice of Committee Conference and Evidentiary Hearing, indicated an interest in the CECP fire suppression system and whether it is connected to the City's potable water system. Dr. Greenberg's testimony briefly and separately addresses this issue. Exhibit A also includes Staff's recommended condition (**HAZ-10**) to prohibit "gas blows" using flammable gases to clean new gas pipelines connected to the power plant. This practice resulted in a newsworthy 2010 accident at a power plant in the eastern United States (Kleen Energy).

Staff has provided extensive testimony on the electric reliability and environmental benefits that the project provides, and believes that these are "extraordinary" as the term is used in the Carlsbad Redevelopment Agency's Area Plan. However, Staff generally supports a requirement that the applicant close and remove the older, existing buildings and infrastructure that will cease to be useful when Encina Power Station Units 4 and 5 are retired. As the Presiding Member's Proposed Decision indicates in its discussion on Land Use, the City's Specific Plan -144 already requires such removal.

EXHIBIT A

Technical Area: WORKER SAFETY / FIRE PROTECTION

Author: Dr. Alvin Greenberg

Background

On December 22, 2010, the Palomar Combined Cycle Power Plant in Escondido, California experienced a fire in the Unit 1 step up transformer. The duration of the fire event was 27 hours and the transformer was destroyed. No water deluge system or other fixed fire-suppression system exists at the Palomar transformers; water application by fire hose was used to suppress the fire until the Marine Corps base at Camp Pendleton was contacted to assist with the firefighting effort using foam. These types of transformer are critical components of a power plant. There is often no spare transformer available in a reasonable time-frame and thus this fire has reduced power generation at the Palomar plant for a considerable period of time while a transformer is located and installed.

According to a preliminary report from Butch Walls, EDM Services, the reinforced concrete blast wall adjacent to the transformer remained intact and thus prevented any apparent damage to the adjacent equipment and structures. Mr. Walls stated that there were indications that the root cause of the failure may not have been within the transformer itself. Nevertheless, Mr. Walls made several observations and recommendations that would serve as an early-warning system of potential transformer explosion/failure, as well as preventing fire damage. These included:

1. Instrumentation to monitor dissolved gas within the transformer oil was not yet calibrated and functional; the use of electronic dissolved gas analyzers is becoming widespread in the industry.
2. It appears that the Escondido Fire Department did not possess the proper fire fighting foam equipment to extinguish the pool fire within the transformer spill secondary containment area. Incorporation of fixed fire foam systems instead of the more traditional water deluge system for the transformers may be prudent.

A review of the technical literature on transformer explosion/fire prevention shows that many new advances have occurred in the past several years. Recognition of the criticality of transformers in the production and supply of energy has spurred development of new approaches. These new approaches include:

1. Use of new dielectric fluids (esters)
2. Pressure sensors with shut-down capability
3. Dissolved gas analyzers
4. Use of compressed-air-foam for fire suppression
5. Sub-surface vaults to contain spilled/leaked dielectric fluids

Discussion

1. Use of new dielectric fluids (esters)

The replacement of mineral oil with fire-resistant ester-based dielectric fluids is probably the single most effective and practical means to reduce the risk and consequence of power plant transformer fires. Ester-based dielectric fluids include synthetic esters such as poly (pentaerythritol) esters and natural esters such as vegetable (e.g. soy) and seed oils (IEEE Industry Applications Magazine May/June 2000). The ester-based dielectric fluids currently available are so much less flammable than mineral-based fluids that many experts in the field believe that fire suppression equipment may be eliminated altogether [U.S. Bureau of Reclamation 2005; C.P. McShane, Jerry Corkran, John Luksich, Kevin Rapp, "Natural Ester Dielectric Fluid Development," 2005 IEEE/PES T & D Conference Panel Discussion on "Progress report on Natural Esters For Distribution and Power Transformers – P. Hopkinson et. al, New Orleans); Moore 2006 (Paper reprinted, with permission, from Steven P. Moore and Waukesha Electric Systems, Inc. IEEE PES Transmission and Distribution Conference, Dallas, TX)]. The flash point and fire points of these ester-based fluids are well above 572 °F (300 °C). One insurance company (Factory Mutual Insurance Company) has stated that the use of an approved ester-based fluid would obviate the need for water spray protection or barriers if minimum spacing is provided. Environmental benefits are also achieved because cleanup is easier as the fluids are considered non-toxic. Safety is also improved since transformer explosion is essentially eliminated and site security is improved by providing a less volatile and therefore less attractive target.

2. Pressure sensors with shut-down capability

These pressure sensors have the ability to monitor pressure fluctuations with the transformer dielectric fluid, detect an increase in pressure, and provide pressure relief (via a relief valve) within milliseconds so as to avert an explosion or rupture of the case. In a sense, these systems act similarly to a mechanical pressure relief valve (PRV). The downside is that if the pressure sensors fail, the sensors could send false positives resulting in an unplanned power plant shutdown.

3. Dissolved gas analyzers

Dissolved gas analyzers are recommended by almost all fire and power plant experts as a useful method to monitor the state of the transformer and its fluid. This can serve as an early-warning system of possible transformer failure.

4. Use of compressed-air-foam for fire suppression

Instead of using a water deluge or spray system for fire suppression of a transformer fire, foam offers the advantage of more efficiently extinguishing a fire and leaving behind a significantly lower volume of contaminated fluids. However, these systems are not recommended at this time for fire protection at existing U.S. Bureau of Reclamation facilities because in the Bureau's view, "foam has no documented

history for use on outdoor transformer fires, it leaves an environmentally unfriendly residue” (albeit of much lower volume than the use of water), “it provides no cooling action”, and “it is extremely slippery”.

5. Sub-surface vaults to contain spilled/leaked dielectric fluids

The concept is simple: drainage of leaked dielectric fluid to a subsurface vault results in an oxygen-deprived atmosphere and less surface area for a fire to thrive. Should a transformer leak occur, automatic or manually activated valves would be available to allow the entire amount of dielectric fluid to drain from the damaged transformer into the subsurface vault. This would greatly reduce the risk of fire involving any remaining fluid left in a damaged transformer. However, the benefit of a subsurface vault is outweighed by the difficulty in placing a sump at the location of the transformers and the very large volume that would be needed to contain the spilled fluid plus fire-suppression water plus precipitation events that could be generated during and after a transformer fire. (The Palomar transformer fire occurred during a period of rain.)

Proposal

Staff believes that a performance standard requiring power plant applicants and owners to develop and submit a plan for review and approval would be the most efficacious manner of achieving greater safety at different power plants. It appears that all power plants could benefit from installing dissolved gas analyzers and may also benefit from using ester-based dielectric fluids instead of mineral oil. Staff therefore proposes the following Condition of Certification to further reduce the risk of a transformer fire.

WORKER SAFETY-10 The project owner shall prepare a Transformer Fire Protection Plan which shall evaluate any feasible methods that can be used to prevent, contain, and control a transformer fire, including: use of new dielectric fluids (esters); pressure sensors with shut-down capability; dissolved gas analyzers; use of compressed-air-foam for fire suppression; and, sub-surface vaults to contain spilled/leaked dielectric fluids. At a minimum, the Plan shall include evaluation of ester-based dielectric fluids. The project owner shall submit this Plan to the CBO for information, to the Carlsbad Fire Department for review and comment, and to the CPM for review and approval.

Verification: At least 60 days before the arrival of a transformer on site, the project owner shall submit a copy of the Transformer Fire Protection Plan to the CBO for information, to the Carlsbad Fire Department for review and comment, and to the CPM for review and approval.

Response to Committee Questions on Fire Protection Water Supply

Staff wishes to respond to the Committee's request for clarification regarding the fire protection water supply. The proposed project will use both the existing City water system and a new on-site 250,000 gallon fire water storage tank. The City water supply would be the first source used in the event of fire-fighting needs. The on-site storage tank would serve as back-up.

The current site has an existing fire water loop consisting of pipes and fire hydrants located on the berm above the existing oil storage tanks. This system is required to suppress an oil tank fire should one occur and will remain operable while fuel oil tanks are present. This existing system is connected to the City of Carlsbad's fire hydrant system which is the same water system that provides potable water for other consumptive industrial, residential, and fire-fighting purposes throughout the City as well as to the Encina Power Station for consumptive and fire protection uses.

The new fire water storage tank will be filled with water from this system and remain available as a dedicated source of water to fight fires on the power plant site. Water from the tank will be supplied at the required flow rate and flow duration consistent with LORS by an electric jockey pump and a back-up emergency diesel engine fire water pump. The tank would be replenished by water from the City water supply system.

In the event of an extreme emergency where the City water supply was compromised, the fire water tank would serve as the primary source of fire protection water. In this sense, the tank is a more stable and secure source of fire protection water in that it would not be subject to loss of flow and/or pressure due to outside events that place a demand on the City water supply or due to pipe rupture.

Technical Area: HAZARDOUS MATERIALS MANAGEMENT

Author: Dr. Alvin Greenberg

Background

On June 28, 2010, the United States Chemical Safety and Hazard Board (CSB) issued Urgent Recommendations to the United States Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), the American Society of Mechanical Engineers (ASME), and major gas turbine manufacturers to make changes to their respective regulations, codes, and guidance to require the use of inherently safer alternatives to natural gas blows for the purposes of pipe cleaning. Recommendations were also made to the fifty states to enact legislation applicable to power plants that prohibits flammable gas blows for the purposes of pipe cleaning. In accordance with those recommendations, staff proposes Condition of Certification **HAZ-10** which prohibits the use of flammable gas blows for pipe cleaning at the facility either during construction or after the start of operations. All fuel gas pipe purging activities shall vent any gases to a safe location outdoors, away from workers and sources of ignition. Fuel gas pipe cleaning and purging will then be consistent with the provisions of most current versions of the National Fuel Gas Code (NFPA 54) including all Temporary Interim Amendments.

HAZ-10 The project owner shall not conduct or allow any fuel gas pipe cleaning activities on the site involving fuel gas pipe of four-inches or greater external diameter, either before placing the pipe into service or at any time during the lifetime of the facility, that involve “flammable gas blows” where natural (or flammable) gas is used to blow out debris from piping and then vented to atmosphere. Instead, an inherently safer method involving a non-flammable gas (e.g. high pressure air, nitrogen, steam) or mechanical “pigging” shall be used. The project owner shall prepare a Fuel Gas Pipe Cleaning Work Plan which shall indicate the method of cleaning to be used, what gas will be used, the source of pressurization, and whether a mechanical Pipeline Inspection Gizmo (PIG) will be used, and submit this Plan to the CBO for information, to the Carlsbad Fire Department for review and comment, and to the CPM for review and approval. Exceptions to any of these provisions will be made only if no other satisfactory method is available, and then only with the approval of the CPM after review and comment from the CBO and the Carlsbad Fire Department.

Verification: At least 30 days before any fuel gas pipe cleaning activities involving pipe of four-inches or greater external diameter, the project owner shall submit a copy of the Fuel Gas Pipe Cleaning Work to the CBO for information, to the Carlsbad Fire Department for review and comment, and to the CPM for review and approval.



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**APPLICATION FOR CERTIFICATION
FOR THE CARLSBAD ENERGY
CENTER PROJECT**

**Docket No. 07-AFC-6
PROOF OF SERVICE
(Revised 1/24/2011)**

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DECLARATION OF SERVICE

I, Maria Santourdjian, declare that on May 17, 2011, I served and filed copies of the attached Supplemental Staff Filings, dated May 17, 2011. The original document filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at: [\[http://www.energy.ca.gov/sitingcases/carlsbad/index.html\]](http://www.energy.ca.gov/sitingcases/carlsbad/index.html).

The documents have been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

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CALIFORNIA ENERGY COMMISSION

Attn: Docket No. 07-AFC-6
1516 Ninth Street, MS-4
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I declare under penalty of perjury that the foregoing is true and correct, that I am employed in the county where this mailing occurred, and that I am over the age of 18 years and not a party to the proceeding.

Originally Signed by
Maria Santourdjian